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AUTHOR St. Thomas, Sister
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ABSTRACT

The use of computers in hospital clinical nursing and implications for the education of nurses were studied with a sample of 130 hospitals. Of concern was how computers were used, which hospital personnel used computers in health care, costs to educate staff nurses, and who teaches nurses about computers. Questionnaires completed by hospital data processing managers revealed that 29% of the hospitals did not have computers for clinical nursing, although many were planning or were scheduled to implement computer use. Where computers were available, they were used in clinical units but there was limited availability of computer interface with technical medical instruments. A majority of respondents said that to be most effective the nurses should be involved in computer planning for use in clinical nursing. Registered nurses and ward secretaries were the primary computer users. Inservice education was reported to be costly, and an increase in that cost was noted in intensive care units. Further research about computer application and use by nurse health care providers and about computer knowledge needed by new graduates was recommended. The questionnaire and a model computer education module for nurses are appended. (SW)

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EXAMINATION OF COMPUTERS IN HOSPITAL CLINICAL NURSING: IMPLICATIONS FOR NURSING EDUCATION

by

Sister St. Thomas

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A Major Applied Research Project presented in partial fulfillment of the requirements for the degree of Doctor of Education

Nova University

October, 1985

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Abstract of a Major Applied Research Project Presented
to Nova University in Partial Fulfillment of the
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COMPUTERS IN HOSPITAL CLINICAL NURSING:

IMPLICATIONS FOR NURSING EDUCATION

by

Sister St. Thomas

October, 1985

The purpose of this descriptive study was to examine computer use in hospital clinical nursing and the implications for the education of nurses. The investigation of computer use in clinical nursing focused on how computers are used in hospital clinical nursing, which hospital personnel use computers in the delivery of health care, what is the cost involved to educate staff nurses, and who teaches nurses about computers? A questionnaire was developed and sent to the data processing manager at each of the hospitals in the sample population. Two hundred four hospitals were chosen from those listed in the 1984 Electronic Computing Health Oriented Directory as the sample population. Forty-nine percent responded and provided the data which were the bases for the study. The treatment of the data was done by using SPSSX. Variable frequencies and percentages were used to interpret the data. Of those responding, 29 percent did not have

computers in use for clinical nursing, although 55 percent of that group were in the planning stage and many of those were scheduled to implement computer use in 1985. The major results of the study showed that where computers were available they were being used in clinical units but that there was only limited availability of computer interfacing with technical medical instruments. A majority of the respondents said that to be most effective the nurses should be involved in computer planning for use in the clinical nursing setting. Findings showed that registered nurses and ward secretaries were the primary computer users with usage highest among ward secretaries and lowest among doctors. In-service education was reported to be costly, and an increase in that cost was noted in intensive care units. Responsibility for computer education of nurses was seen as an area needing further study.

Recommendations from the project include the need for further feasibility studies to be conducted by collegiate personnel to ascertain computer knowledge needed by new graduates, for hospital personnel to do cost factoring studies of training nurses in computer use, and for collegiate computer courses to be developed that incorporate knowledge needed by nurses for computer input/output, development of nursing care plans, computer interface with nursing instruments such as thermometers,

calculations for drugs, ECGs, and drug administration control. A prototypical computer education module for nurses was developed.

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Chapter 1

INTRODUCTION

Computer technology is exploding so rapidly one can become lost in its proliferation and quickly lag behind in technological knowledge. Nurses are a case in point. In the world of nursing with the rapid turn-over of clients and the ever-increasing amount of record-keeping, there is little time remaining to do the necessary nursing research and provide the input into computer programming that this computer technology requires. Quality nursing care calls for effective communication techniques that will keep up with the demands for health-related communication for nursing, yet computer courses are not presently geared toward computer education in nursing nor has nursing education been quick to incorporate computer training into the nursing skill requirements. In examining collegiate computer course offerings, one finds courses in Basic, Fortran, and Pascal languages, in programming, word processing, records management, and in the numerous areas which are all pertinent to the business world. A review of the literature up to 1980 showed little documentation of computer research as it relates to nursing clinical needs and to computer education needs of nurses. There was an increase in the amount of literature dealing with computers in nursing

after 1980. Along with this increase of interest has come a phlethora of workshops dealing with computers in medicine and nursing.

Educating nurses in effective use of computers is a major challenge for the collegiate world, and Norwich University (VT) is no exception in the need for computer education for nursing students. The nursing program at Vermont College of Norwich University first introduced computer use in 1982 in an attempt to provide introductory computer knowledge. The student nurses were allowed to take mastery exams for selected independent modules of learning on a computer after they were given an introduction of the basic on-off operation of the computer and taught to respond to mastery exam questions.

This study was undertaken as a response to the growing need to know what competency nursing students should have with computers. The purpose of this study was to investigate computer use in hospital clinical nursing in order to determine how computers are used, who uses them, who trains nurses to use computers, and who should train nurses to use computers.

Background and Significance

The need for this study seemed evident because of the rapid movement of computer technology into the hospital health care delivery system. Biomedical technology has already had an effect on medical health care. Most nurses

are faced with the use of a technology that they have not been exposed to nor been educated to use. The literature showed that computers are primarily used in hospitals to manage information and to facilitate interdepartmental communications. As nursing becomes more complex and the necessity for communication increases, computers will sort large volumes of data with accuracy, disseminate information, and provide nursing care planning based on nursing diagnoses, patient outcomes, and nursing action. Furthermore, computer interface with instruments is an area of computer use that can improve critical care nursing. Such advances should stimulate nursing educators to respond to advanced technology and demand a closing of the gap between what veteran registered nurses know and what new graduates should know. If hospitals are going to be cost effective, they cannot expend money to re-educate nurses in new technology, especially those nurses who are new graduates of nursing programs.

Research Questions

Based on a review of the literature, the following research questions will be addressed in this study.

1. How are computers used in hospital clinical nursing?
2. Which hospital personnel use computers in the delivery of health care?
3. What is the cost involved to educate hospital staff nurses in computer use?

4. Who should teach nurses how to use computers for health care delivery?

Definition of Terms

The following definitions will aid the reader in interpreting this project.

Computer program:	step by step instructions written in computer language which gives commands to a computer
Computer programmer:	an individual who writes a series of instructions to tell the computer how to process the input and how to output the processed data
Computer specialist:	one who has technological knowledge of computers, though not necessarily a programmer
ICU's:	intensive care units
Intensive care:	hospital units accommodating patients who are critically ill
Interdepartmental services:	services between and among various units of a hospital
Instrument interface:	computerizing information through the use of instruments used for measurement such as temperature, blood pressure, and heart beats
Monitor:	a screen with the ability to depict a picture

Definition of Terms (cont.)

Nursing care plan:	a prospective synthesis of several treatment plans
Printer:	a machine capable of producing a hard copy
Software:	computer programs ready for use

Limitations

The following factors may have affected the results of this research project.

1. The survey population was limited to the Electronic Computing Health Oriented (ECHO) members, a group specifically showing interest in computer technology.

2. The study was concerned with computers used in hospital clinical nursing during 1984; therefore, no generalization should be made to other nursing situations, other institutions, or other years.

Assumptions

The concepts advanced in recent literature about computers in education and health care delivery do contain implicit and explicit statements about computer use in clinical nursing. In this study one should assume that:

1. The respondents answered the questionnaire honestly and factually.

2. Hospitals other than those in ECHO do use computers.

3. The computer is a viable tool in hospital clinical nursing care.

Assumptions (cont.)

4. The computer can help the nurse document the data that occur in the health care field.

5. The computer does free the nurse for more direct client care.

6. Educating nurses in computer use has an important effect on institutional budgeting.

7. Adequate information will be available about computer use in clinical nursing to project educational needs that might be prototypical.

Chapter 2

REVIEW OF THE LITERATURE

As advanced technology assaults the health care industry, ways must be found to say yes to relevant technologies that can improve health care without putting a drain on health care finances. Some of the newer technologies that health care is facing are telecommunications, personal computers, teleconferencing, imaging systems, bedside terminals, and office automation. These newer technologies, if used extensively, will necessitate organizational changes in order to have the systems fit into the health care delivery. The impact on the nurses and nursing care may be considerable whether nurses are dealing with management, economics, or bedside nursing. And since nurses represent the largest working force in the health care industry, they are becoming more and more exposed to the innovations resulting from computer usage.

A search of the literature showed that the spectacular growth of computer in numbers, in capacity, and in application since 1950 is the result of many people trying to solve many problems in many fields while getting on with the business of life in general. Educators often ask whether colleges and universities are able to provide both liberal education and preparation for work. The

assumption is that colleges and universities should provide both since the two go together (Chickering, 1982). Cardinal Newman (1973), challenges the educational system to prepare the student to fill any post with credit and to master any subject with ease. The idea that all students need to be acquainted with computers and their use is no more radical a thought than that students should be able to read or write. Eli Ginsberg (1976) documents that today's work force is service centered and that the consequences of this have increased the demand for professionals in the health and education fields. This demand has taken on new meaning with the advent of computers in the working world because the explosion of computer use requires that college graduates entering the job market should have more than a mere acquaintance with computers. Computer literacy is no longer a new notion. Industry, education, and the health field have literally moved into the computer age. Educators have surged ahead in 1981, 1982, and 1983, in either requiring entering freshmen to own microcomputers and/or to be computer literate upon graduation. While computer literacy has a variety of definitions by users, it is primarily thought of as some kind of ability in using computers in one's area of expertise, work, or discipline. Technological advances have become an integral part of the hospital environment (Tarrant, 1966) and the need for computer literacy presents new challenges to the profession of nursing (Mirin, 1981). Accurate and readily available

information is perhaps as important in nursing knowledge as are practical skills in determining the quality of care (Pritchard, 1982.) While many tasks performed manually by nurses cannot be replaced by computers, computers can assist the nurse in calculating and analyzing data quickly (Rosenberg and Carriker, 1966). Furthermore, a great deal of medical information can be stored in a small space for quick retrieval by the health-caring profession. If one accepts the premise that the extensive use of computers in health care is inevitable, then there is an assumption that nurses will become increasingly involved in planning for and using computers in health care delivery (Ronald, 1979).

A search of nursing literature showed according to Pocklington, et at. (1980) that there are no neatly packaged courses for health professionals in computer technology. Yet, as early as 1966, Rosenberg (1966), in writing about computer use, suggested that computers could provide better observations of patients as well as accurate, printed transmission of observations. In 1967, fewer than 5 percent of the hospital institutions in the United States had a computer on order or installed (Weil, 1967). Fourteen years later, Mirin (1981) reported that the educational literature offered more information on the computer's role in the elementary school than in higher education; however, the nursing literature describes only a few instances of using computers in teaching.

The literature showed that the use of computers in Great Britain's health care delivery has come about more slowly than in many other disciplines or fields of work. Scholes (1979), writing in Nursing Times, reported that a computer was first used at London Hospital in 1965 for financial purposes and for organizing and storing immunization and vaccination data for the British health programs. The first clinical system developed dealt with requisitioning and reporting of laboratory services so that doctors could receive microbiological results on the visual display and make comparisons of reports. Other British hospitals began to use computers to help plan radiation treatment and to do statistical analyses, health screening, monitoring, and electrocardiography interpretation. While the use of computers was found satisfactory by doctors, nurses, and clerks at the London Hospital, it was necessary to make the computer staff available to give day-by-day support and advice. Barber (1979) in reporting about the British system of computers, states that computers provide unfailing reminders of desired action and that the improvements in uptake are significant by comparison with ordinary clerical systems. Barber (1979) has highlighted in a study the need for educating the users of computers and for encouraging the involvement of nurses in the design, development, and use of hospital and community computer systems which are valuable in health care.

In 1958, an electronic firm specializing in the design of computing systems presented the American Hospital Association (AHA) with a plan for computer use in hospitals. The study recommended that the clerical work be reduced by computerizing the hospital business office (Veazie and Dankmeyer, 1980). Surveys done by the American Hospital Association showed that in 1962, 39 hospitals were using computers; in 1970, 2,887 hospitals; and by 1976, 3,983 hospitals were using computers in their business offices (Veazie and Dankmeyer, 1980). In the United States, Rosenberg (1969) reported that the Institute of Living in Connecticut used automated nursing notes in 1966. He reported that an extensive study was conducted to establish the value of automated notes over narrative notes, and the study showed that this type of charting had potential for quantification and could provide statisticians with literally thousands of reports for analyses. By 1969, the Highland View Hospital in Cleveland had developed Scheduled Activities of Nursing (SCAN). SCAN provided a computer printed nursing care plan for each patient and the plan was given to the nurses caring for that patient. With SCAN it was possible to hold personnel accountable for care and at the same time eliminate time-consuming written and verbal assignments (Speed and Young, 1969).

The 1960's saw one of the earliest attempts to use computers for patient care at the Rockland County Health

Department in New York. Saba (1978) reports that computerized collection of patient data helped to determine staffing requirements wherever institutions used them. At Charlotte Memorial Hospital in North Carolina, nurses worked to computerize nursing care plans. Their efforts were compiled in a published manual that contained over 200 components of patient care (Somers, 1971). At the Texas Institute of Rehabilitation, Cornell and Brush (1971) cites the use of automation whereby the client's care, daily activities, and levels of independence are arrived at through the use of the computer. Furthermore, automation was one of the catalysts that led to the First National Conference on Classification of Nursing Diagnosis (Gebbie and Lavin, 1975).

In attempting to determine what computers can offer for nursing today, published articles based on research will not suffice because such data are scarce. The evolution of new technology frequently is stymied by man's lack of vision about its impact on society until the individuals themselves are imminently impaired by their lack of involvement. In order to prevent a similar crisis in the health field, educators need to explore and project the impact computers will have on health care delivery in the future.

One of the major reasons for using computer technology is to improve the efficiency with which information can be stored and retrieved. Edmunds (1982) states that the potential for the use of hospital-wide computerized information systems in the provision, documentation, review, and development of high-quality nursing care seems unlimited. According to Edmunds, nurses could make entries into the computer, requisition laboratory studies, retrieve reports, and retrieve information on transfers and discharges. Such storage and retrieval of patient and medical information might strengthen the quality of health care. For example, Dr. Lawrence Weed (1975), one of the forerunners of computer use in client care, established at the Medical Center Hospital in Burlington, Vermont, the "Problem Oriented Medical Record" (PROMIS) method. This allows nurses and doctors to computerize patients' problems and to retrieve progress notes relevant to a single medical-nursing problem. Burlington nurses reporting for duty using the PROMIS method receive a computer print-out on each patient's condition, problems, and expected nursing care.

Computer technology has changed the practice of modern medicine, especially in applications of laboratory technology, on-line patient monitoring, and computerized axial tomography (Friedman and Gustafson, 1977). Bronzino (1982) described computerized patient monitoring systems as

consisting of three distinct processes, namely, (1) the detection phase whereby physiological data (e.g. temperature) is registered; (2) the interpreted phase in which data is ranked and assembled; and (3) the analysis phase in which data are evaluated using programmed instructions. The computer system displays pertinent patient data, stores the data for future use, and directly controls various devices such as fusion pumps. To date, patient-monitoring equipment is used in diagnostic clinics, in treatment areas such as operating/delivery rooms, and in surveillance instances such as surgical, medical, coronary, and neonatal intensive care units. The advantages to the health care provider include continuous and accurate monitoring of physiological data, rapid computerization of data for clinical review, documentation, and selection of treatment. Current computerization of health care in hospitals aids in the management of hospital information systems that handle the billing, admission, discharge, and transfer of patients. Computers are also used on nursing units to communicate with the pharmacy, the laboratory, and other interdepartmental hospital units. Currently, there are medical information systems that are either being developed or are operational as research projects. These latter are being used to collect data on patients to differentiate diagnoses and recommend therapeutic procedures (Veazie and Dankmeyer, 1980).

In 1977, the city of Philadelphia developed a patient centered data system which was eventually adopted for use by five medical schools, five nursing schools, and by two hospitals. This patient-centered system reflected outcomes of care. A nursing task force, funded by a federal grant, developed the Nursing Problem Classification that provided continuity in teaching related to the health activity of approximately 30,000 children. The project demonstrated that nursing management personnel and doctors need formal preparation in automation and that continuing education should be mandatory if successful communication is to occur with data system analyists. At the same time, the project showed that progress was impeded by opposition from physicians and other health care providers (Walker, 1977). Computers have enormous potential for assisting nurses in clarifying, teaching, implicating, and expanding the principles of high-quality patient care (Zielstorff, 1980). What does this mean to nursing care? It means that the nurses can be free from the repetitive manual method of measurement and can concentrate on direct patient care. By using a computer, the nurse can also record and/or retrieve information much more rapidly, thus giving her valuable time for other nursing tasks.

In 1971, computer-generated nursing care plans were introduced at El Camino Hospital in California. El Camino Hospital was the first to use Technician Medical

Information System (TMIS) which provided data immediately upon request. Stanford Hospital in California and Strong Memorial Hospital in Rochester, New York, computerized monitoring in the cardiac unit for QRS-shaped heart tracings to detect ventricular arrhythmias which account for 40 percent of all myocardial infarct deaths. Nurses watch the electrocardiogram (ECG) for premature ventricular contraction (PVC) and treat patients before ventricular tachycardia and fibrillation occur.

In other situations, the Video Matrix Terminal (VMT) is used. This is comprised of a ten-inch television screen, a keyboard, and a light pen which reflects a beam of light when it is directed at a word on the screen. The nurse activates the computer by introducing a code number and then proceeds to call up the patient's record and doctor's orders and to requisition medications, laboratory tests, or x-ray reports by merely selecting the item from a computerized program instruction. This allows the nurse to control the plan of requisitions rather than consume valuable time in manually transmitting doctors' orders and in requisitioning tests. Another computer method used is a touch-sensitive screen on which the user can call up information. New material is added to the patient's record by typing on an attached terminal keyboard. In addition, generic medical information (drug and bibliography) can be stored in the computer's memory for

use by the doctors or nurses (McNeill, 1979). McNeill further states computerized nursing tends to eliminate task-oriented nursing.

Other hospitals have studied and used automation in nursing care. One is John Hopkins Hospital which developed the computer-assisted unit-dose drug distribution system (Simborg and Derewicz, 1975). The Walter Reed Hospital is another which has done research for automating patient data (Johnson, 1978), and the Harvard Community Health Plan was computerized in order to better serve the Greater Boston health needs (Gluck, 1979).

Nursing Education

Major nursing problems which arise from the use of computerized technology are due to staff members not having sufficient expertise to interpret results or being unaware of the factors affecting the accuracy of a measurement (Bronzino, 1982). Educating the users is a major problem especially where there is frequent nursing staff turnover According to Barber and Scholes (1979), although computer use ideas came from the medical staff, nurses were quicker to grasp the practical potential at the service level. For this reason, interest has been in the area of simplifying clerical activities. Most authors reporting about computer use in nursing indicate computers are used in nursing management where clerical activites abound. This seems logical since record keeping is time consuming and it is

this kind of clerical work that tends to keep the nurses at the desk and not at the patient's bedside. Brown (1971) reported that computerized information systems used in community health delivery are handicapped by the lack of standard terminology and agreements as to what constitutes relevant data. Brown points to the necessity for nursing involvement in the planning stage whenever and however computer technology is planned for health care delivery. Having computer access to patient information and the ability to understand correlations between problems and treatments allows the nurse to do much more than follow orders and respond to crises. Furthermore, the nurse cannot excuse poor performance by professing lack of knowledge, memory failure, or lack of access to needed information when computers can provide storage and quick retrieval. McCormick (1983) warns educators to be cognizant of the future needs of nursing. She states that while computers are being used to document nursing care, there are few schools of nursing that provide even the most basic literacy program on computers in nursing. In a 1975 survey of 200 schools of nursing inquiring about the use of computer assisted learning (CAL), only 11 (7 percent) of the 155 respondents indicated CAL was used (Pleasant, 1983). This points out a computer lag in collegiate education. If by 1990, predictions become reality, computer use in health care will multiply and hospitals

will be faced with the increased cost of teaching nurses on the job. If a hospital nursing department maintains a turnover rate of 20 percent, and if in-service education for computer use takes 20 to 40 hours to teach, the cost to the hospital would be an additional $20,000 each month to keep a 500-member nursing staff capable of documenting nursing through automation. McCormick (1983) cites a study done by Kralovec which found that in-service education costs for intensive care nurses increased by as much as 500 percent.

At present, more than two-thirds of American community hospitals use computers in some capacity. Accumulated computer records provide an unparalleled tool for nursing audit and for research into all phases of the nursing procedures through comparison of outcomes of large numbers of patients. Computers can offer coordination and continuity of care. One must remember that the computer can travel only along the path of logic programmed into it, and logic may be riddled with errors, sometimes subtle and difficult to detect (Tamarisk, 1982).

One example of successful computer use is at Good Samaritan Hospital in Cincinnati, Ohio, a 760-bed private, tertiary, teaching hospital which began to use computers in the 1960's. Their effort to advance computer use into client care is to be admired. Working to make significant technological advance more humane in its application is,

after all, part of the essence of nursing (Powell, 1982). Another example is the Little Company of Mary Hospital (LCM) in Evergreen Park, Illinois, which has a 500-plus bed acute care facility with a heavy patient load. LCM Hospital has been "on-line" for over 10 years. Here the computer is programmed to report the results of a 12-lead ECG with interpretation within 4 to 6 minutes after the test is done. The computer maintains a system in which it will prevent two ancillary services from scheduling the patient for tests or treatments at the same time. By using this computer system, the LCM Hospital has improved the quality and quantity of patient teaching (Reilly, 1982).

While there are some computer-assisted functions which are basic to most hospital information systems and serve all users, there are a variety of applications that have been developed specifically to assist nurses in providing patient care. The existing and potential applications fall into five groups: storage and retrieval of clinical and statistical data, educational materials, patient care plans, care audits, and research. With regard to nursing care plans, a computer system can store standardized care plans that the nurse can use as the foundation for planning individual patient care. Such care plans might contain the minimal care requirements of patients in certain groups or might list a variety of options from which the nurse would choose the most

appropriate. Computer-assisted care planning can educate the novice nurse in formulating a care plan and can remind the veteran nurse to be complete in care planning. Automation can minimize the time necessary to record the care plan. Efficiency would be improved by being able to select the items in a computer display that are applicable to a specific patient. In such areas as the nursery or postpartum units where many nursing orders are routine but need to be documented, computerized care plans facilitate the routine without excluding individualization and at the same time preserve flexibility of input.

Computer usage can insure the adherence to the philosophy of nursing care at a particular facility. For instance, Weed's (1975) philosophy is that care should be problem oriented. His PROMIS system prevents an order from being written unless it relates to an identified patient problem. With this system, nursing care services stand to benefit from the efficient storage, retrieval, and extrapolation of information that computer technology allows. As Curtin (1982) states, computers will be cost efficient only if those who program them feed in the proper data and receive the proper feedback. For this reason, it is essential that nurses be aware and open to the idea that computer technology can assist in making some of the profession's dreams a reality (Edmunds, 1982).

Advanced technology has been making significant inroads into many critical areas of hospitals for the last decade.

Technology has had an undeniably positive impact on patient care and on documentation and administration of critical care services. Computer use has provided support to administrative functions, documentation of patient care, monitoring of patient condition, and assistance to the nurse in the functional aspects of nursing especially in intensive care, emergency room, and operating room nursing. The nurse's ability to use several types of physiological monitoring systems could save time and energy in health care delivery.

Health care providers, nurses, and data processing professionals will have to deal with crucial computer use issues if they want to be successful in the acquisition, implementation, operation and use of medical computing systems. Some of the problems nurses will face in using computers will be the reliability of hardware and software, privacy, security, economics, management and organization, and staff education. They will experience success, failures, and frustration in having computers as a component of the health care system. The data processing professionals in conjunction with the nurse will have to develop a cookbook approach to system implementation if the nursing staff is to make the system a part of the daily nursing routine.

Since much of the health care centers on what nurses do or do not do, there is a need for the nurse to understand when information may be stored on a stand-alone computer system and when a subsystem needs to be interfaced with the centralized information system. For this reason, it is

imperative that the flow, validation, and timing of data among hospital subsystems such as the laboratory, radiology, pharmacy and accounting areas be understood by personnel if it is to function adequately.

Conclusions

Based on the literature review the following conclusions can be made:

1. The literature review shows limited research on computer use in hospital clinical nursing.

2. The limited research on computer use in hospital clinical nursing substantiates the need for an examination of how computers are used, what personnel use computers, who should teach nurses about computers, and what is the educational cost to the hospital.

Chapter 3

PROCEDURES AND METHODOLOGY

The purpose of this research was to examine computers in hospital clinical nursing. To accomplish this, input was sought through a questionnaire survey of hospital data processing managers. The goal was to seek information as to how computers were used in clinical nursing, what personnel used computers, what nursing units used computers, who teaches nurses in computer use, what kind of computer specialist assistance is needed, and the cost involved to educate staff nurses.

The major procedures followed in this research included the development of a survey tool for hospital data processing managers, a pilot study using the research survey tool, data collection, and analysis. A prototypical computer education model for nurses was constructed based upon the results of the research. Utilizing the review of the literature about computer use in hospital nursing, a research survey instrument draft was developed. The Survey Research Handbook (Alreck, 1985) and The Guide to Sensible Surveys (Orlich, 1978 were used for form and style.

The research survey instrument consisted of five pages. The first page gave directions and a sample question and answer. The low and high spectrums of the scale

were identified. The questions asked the respondents to select the answer on a five-point Likert scale in terms of actual computer use at their hospital. The choices ranged from no importance to very high importance. The questions were constructed in groups of like material such as:

Computers are used in:

(4)	Emergency room	Low 1 2 3 4 5 High
(5)	Obstetrics	1 2 3 4 5
(6)	Medical unit	1 2 3 4 5
(7)	Surgical unit	1 2 3 4 5
(8)	Pediatrics	1 2 3 4 5

Questions on page 1 and 2 related to how computers were used in client care and which personnel used the computers. This group of questions was separated by a space to allow for comments and to provide a neater format. The third page of questions examined further how computers were used by nurses, who taught computer use to staff nurses, and the cost for educating staff nurses on how to use the computer. On page 4 the questions related to the need for, and the use of, a computer specialist, the necessity of typing ability, and the cost of educating nurses in computer usage. The fifth page asked for a narrative response about what should be included in a prototypical model for nursing education. This page also allowed the option for respondents to sign the survey and to indicate interest in receiving the results of the study.

The questionnaire was then analyzed for instrumentation bias. This was done to see if the response bias was controlled, in part, by the wording and sequencing of

research questions. The nature of the questionnaire topic "use of computers," was such that social desirability was not a response bias concern. Since the questions on the survey did not reflect upon the image or status of the hospital, prestige bias was not a concern either. The study was not a threat to data process personnel because educational questions were depersonalized and respondents were assured anonymity and confidentiality. In addition, the questionnaires were not viewed by other hospital personnel.

An acquiescence bias was addressed by exercising care to provide for candid answers. The use of a Likert scale avoided a provocation of positive or negative answers. The issue under study was such that questions were not personalized and did not evoke hostility. Furthermore, it was not financially feasible to have the survey conducted by an independent agency. A mental set bias was controlled by making it clear to the respondents by layout of the questionnaire that each new set of questions required a shift in their frame of reference. By using a sample item at the beginning of the questionnaire, initiation bias (one phase of order bias) was eliminated. The respondent was required to read and evaluate each question independently and an attempt was made to have each item distinct to insure separate consideration of each question. The brevity of the questions and the length of the questionnaire (69 questions) eliminated fatigue bias.

A Likert scale with five points was used to control extremity bias. From these considerations, the researcher concluded there was an extremely low probability of instrumentation bias. The survey instrument was reviewed by an advisory committee of four collegues, a graduate professor, a research professor, an English professor, and a nursing professor. These professors reviewed the instrument for clarity of instructions, wording, format and sequence of questions, and general structure of the questionnaire. Their suggestions and modifications were incorporated in a revised questionnaire which was again reviewed by the four-member committee. The target population was selected from the 1984 Electronic Computing Health Oriented Directory (ECHO). All United States hospitals in ECHO were identified. The names were listed alphabetically and numbered. A pilot study group was selected by choosing every 30th hospital of the first 300 listed. It was believed that this would give a cross section of hospitals by location in the United States and a cross section of hospital size by number of beds.

A cover letter (Appendix A) was written explaining the purpose of the survey. The letter assured the participants that their identity would be protected if they participated in the survey. This cover letter, the survey instrument, and a postage-paid return No. 9 envelope were mailed to the participants in the pilot study. The purpose of the pilot study was a final check on clarity of

directions, item ambiguity, and any other difficulties that might be anticipated with the use of the instrument. There was a 90 percent response rate from the pilot study group. There were a few responses and comments about the questionnaire and these were incorporated in the final survey instrument (Appendix B).

The major survey used a random sample of 274 hospitals. These were selected by choosing every third number until 274 were chosen. (The number 274 was chosen based on available money for the survey.) Next the chosen hospitals were categorized by regions (Appendix C, D, and E). This was done to assure that the random sample provided similar inquiry rates for each region. A mail survey approach was used to save time and money. (A telephone survey would have been cost prohibitive.) The cover letter,(Appendix F) the survey instrument, and a postage-paid return No. 9 envelope were mailed to each data processing manager in the random sample from the ECHO group.

Upon return of questionnaires they were coded numerically. This was to assure identification of respondents in order to facilitate analysis. Sight-editing was done to sort the questionnaires in order to identify those with computers in use versus those without computers in hospital clinical nursing. Once the surveys were sorted, the data were tabulated and a frequency count was done on each item with the frequencies being represented as

percentages. Pie charts, bar graphs, and tables were constructed to depict the survey findings.

There were 130 respondents for a response rate of 49 percent. Forty indicated they did not currently have computers in their hospital. Of the 40 respondents (30 percent) indicating no computer use in nursing units, 22 stated they were either investigating, planning for, or were about to implement systems (14 to be implemented in 1985).

Because there was a response rate of 49 percent, a sampling bias analysis was conducted in order to identify those factors that might cause bias. The hospitals listed in ECHO were identified by region within the United States. The number of surveys sent to each region was determined and the number of responses from each region was tabulated. A statistical analysis (test of proportions) was done to determine whether or not there was significant difference in response rate by region at the .05 level. No significant difference was found (Appendix G). Next an analysis was done on hospital bed size between the two groups responding (i.e. those with and those without computers in hospital clinical nursing). The two groups were tested with a null hypothesis "hospital bed size being equal" to see if there was a significant difference at the .05 level (Appendix H). A significant difference was found between the mean bed size in the two groups. This finding is considered in Chapter 4.

Summary

Chapter 3 described the procedures followed in carrying out the research objective, namely, examination of computer use in hospital clinical nursing. Instruments were developed to gather the data. A pilot survey was conducted to help validate and clarify the questionnaire. The instrument was mailed to a random sample of Electronic Computing Health Oriented (ECHO) members. Results were obtained and analyzed. A sampling bias analysis, a response bias, and an instrumentation bias were conducted to identify those factors that might cause bias.

Chapter 4

PRESENTATION OF RESULTS

In order to determine the current state of computer use in hospital nursing, a survey was conducted in the summer of 1984. Questionnaires were sent to a random sample of hospitals listed in the 1984 Electronic Computing Health Oriented (ECHO) directory. This population was used because available literature showed little documented evidence of computerization of nursing care in United States hospitals. The belief was that a random sample of the total U.S. hospital population would not lend itself to this study because of the relative infrequency of computer use. By sampling from ECHO, the study had a more relevant potential since subscribed members had an interest in computerized health care.

The results showed that by 1983-1984 computer use in hospitals advanced from nearly exclusive use as a managerial tool in admitting and finance offices to direct use in nursing units (87 percent of the respondents). Computers were being seen as an integral part of nursing care with 82 percent reporting that computers were of moderate or high importance in the actual delivery of care. Computer phobia was nearly non-existent in the surveyed hospitals. Only 11 percent did not view the computer as a viable tool in nursing care. Evidently computers had

been effective in freeing nurses from mundane and time-consuming tasks such as disseminating information, record keeping, and requisitioning interdepartmental services. Nurses in the surveyed hospitals were able to spend more time in direct client care than ever before. Sixty-nine percent of the respondents indicated that the computer freed nurses for more direct client care.

Computers have found their way into virtually all nursing units. Not only are computers valuable in the fast-paced intensive care and emergency room but they are also crucial to the less life-threatening nursing units. These results are depicted in Figure 1.

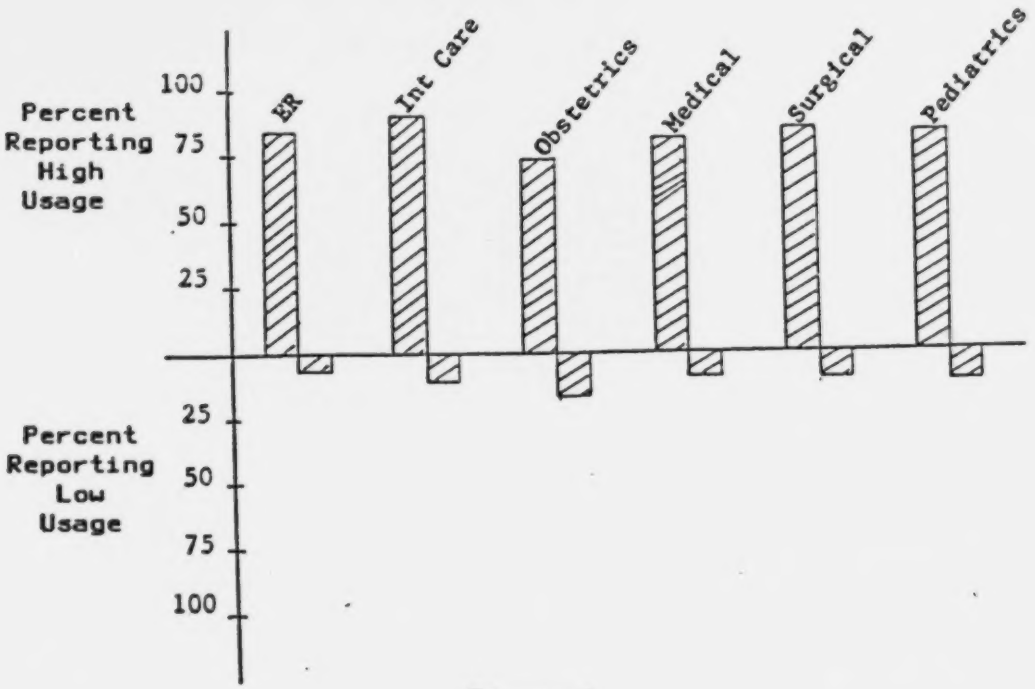

Figure 1

Hospital Computer Use
by Area of
Client Care

Presently, there appears to be limited interface with instruments such as thermometers for client care possibly due to the recent introduction of various types of hardware and software. Only 35 percent of the hospitals surveyed reported computer interface with patient and diagnostic care instruments. There has been little implementation of the latest technological advances. While nearly half (45 percent) of the ICU's have instrument interface, only 1 of every 4 medical/surgical units employ them. Thirty-two percent of the respondents indicated that computers were being used in client care to evaluate and record vital signs. However, 42 percent were still using the manual method for vital sign evaluation. Nearly all hospitals used computers for information management, such

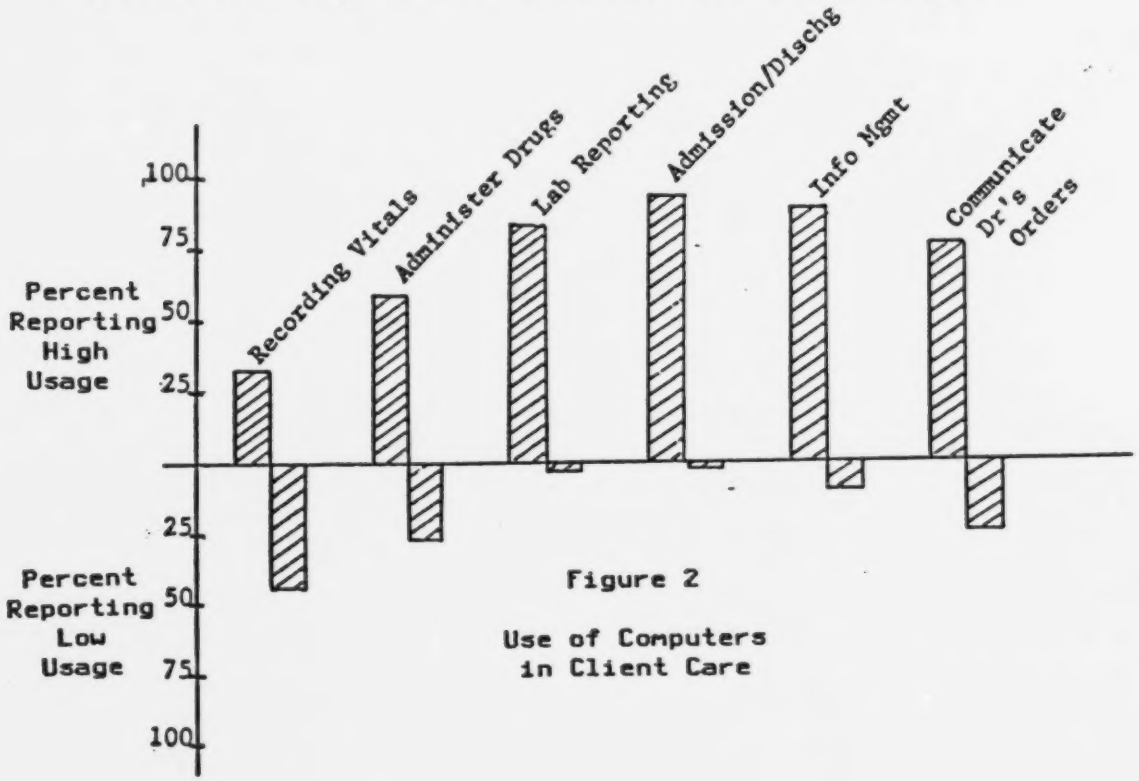

Figure 2

Use of Computers in Client Care

as admission and discharge (95 percent) and laboratory reporting (86 percent). (Figure 2.)

While most of the nursing units have video display terminals and consider them very important (87 percent), 79 percent also rated printers as highly important. Fifty-nine percent of the respondents reported that they are using the type of video screen activated by touch or light pen. The research showed that ward secretaries used the computer extensively (91 percent), while only 78 percent of the registered nurses used the computer. Within the medical profession, 44 percent of the residents and 43 percent of the doctors used the computer. (Figure 3)

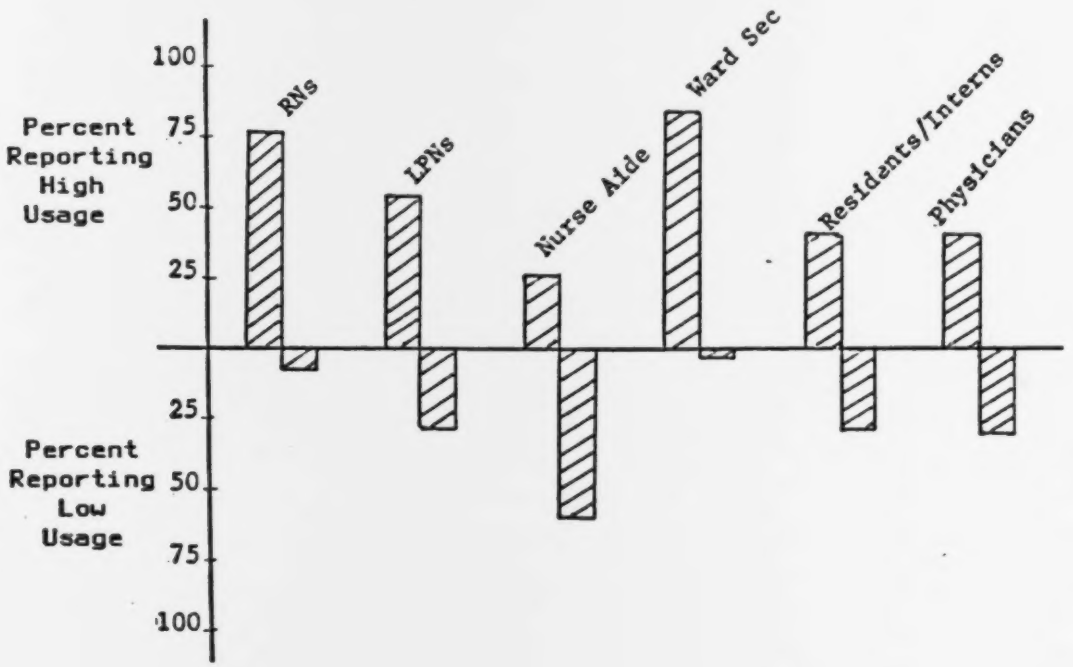

Figure 3

Personnel Using the Computer

Laboratory requisitioning (63 percent) and charting of client care (56 percent) were the most frequent nursing uses of computers. There is somewhat limited use of computers for nursing care plans and discharge instructions. (Table 1)

Table 1

Computer Use on Clinical Units

Computer Usage	High Importance (Percentage)	Little or No Importance (Percentage)
To prepare patient profiles for patient assignments	54	30
To prepare lab requisitions	63	12
To chart	56	32
To prepare discharge	35	48
To develop patient care plans	39	46
To store data related to standards of care and procedures	34	47
To store research data	26	49

In response to the question of necessity for computer knowledge prior to employment, only 17 percent of the respondents indicated high importance and 62 percent indicated little or no importance. Reasons given why computer knowledge is not a prerequisite for employment were that knowledge of one computer system does not necessarily lend itself to another computer system and the limited availability of nurses seeking jobs who have computer knowledge.

Presently only 8 percent of the data processing managers viewed computer knowledge by nurses as an absolute necessity for job placement upon employment, while 20 percent believed that computer knowledge would facilitate job placement. There was overwhelming evidence that nurses who use a computer did not receive higher wages than those who did not use computers. This was confirmed by 94 percent and disputed by only one percent of the respondents. While one third of the respondents viewed pre-employment computer education as slightly more cost effective, the majority (69 percent) did not consider it more costly to train the nurses themselves. Among the hospitals surveyed, 82 percent reported that the nurses who used computers received computer training after beginning their employment. With regard to computer knowledge being essential for nurses working in intensive care units, only 43 percent saw such knowledge as highly important and 30 percent thought the training was of little or no importance. This is reflected in the question related to computer interface of instruments for client care when 45 percent of the respondents gave interfacing high importance and 41 percent, low importance. Slightly less than half (42 percent) of the respondents required nurses to type into the computer and 50 percent indicated that formal typing skills, while not essential, were certainly desirable. As seen in Figure 4, the respondents believe that in-service training is the best way to train nurses in computer use.

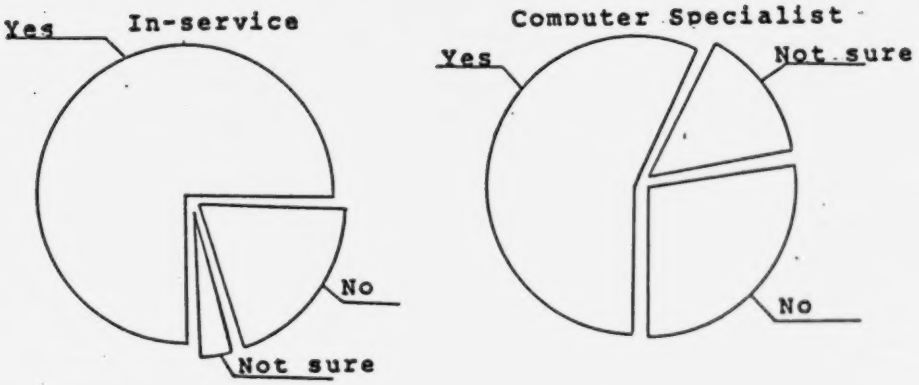

Figure 4

Teachers of Computer Usage to Nurses

Sixty percent of the respondents stated that the computer specialist was needed to help the nurses. Over half the respondents (56 percent) indicated that their computer specialist was a nurse, while only 31 percent of the computer specialists were programmers (Figure 5). On-call service from computer technicians or specialists is essential for the effective use of computers. Seventy percent of the respondents indicated that the specialist was on call and 50 percent indicated daily use of the specialist.

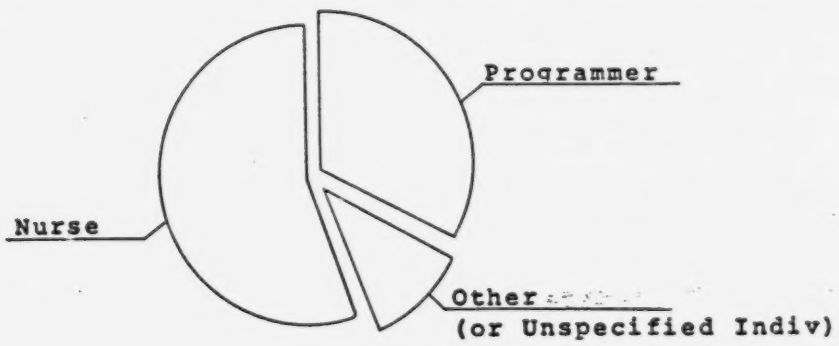

Figure 5

Resident Computer Specialists

Seventy-five percent of the respondents believed that hospital in-service programs can provide the best computer training for nurses, thirty-six percent strongly believed that collegiate nursing programs should bear the responsibility for training, and 20 percent are undecided as to who should educate nurses in computer use. Approximately half (53 percent) thought that a hospital-hired computer specialist should educate the nurses in computer use. Figure 6 depicts the responses.

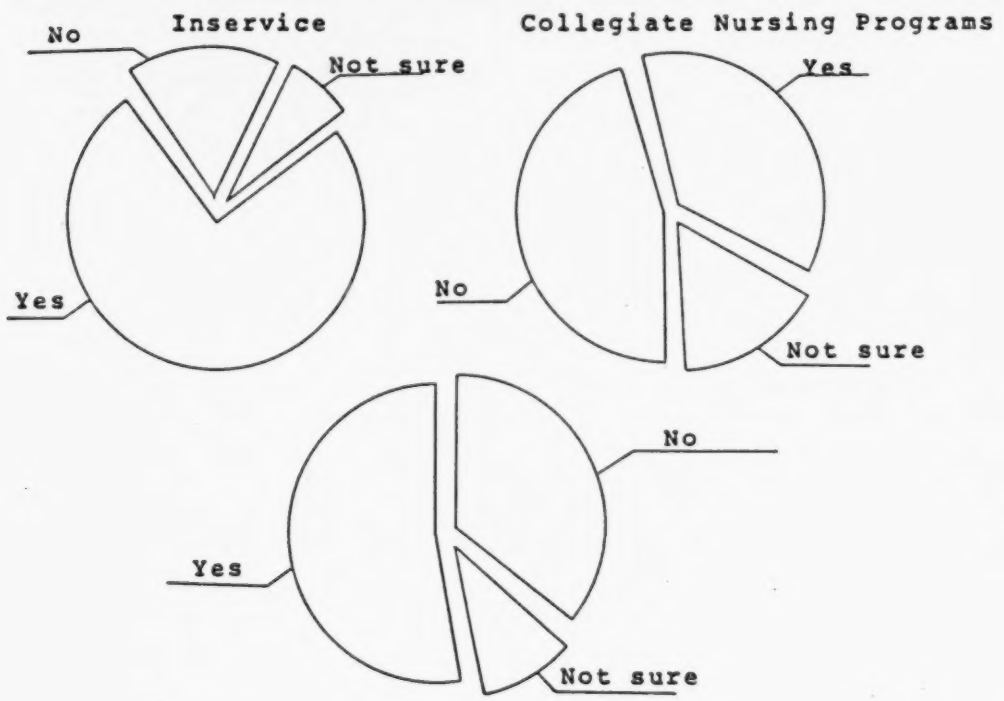

Figure 6

Proposed Educators of Nurses in Computer Use

Most respondents did not answer all of the questions regarding actual nurse education and cost. With regard to the hours of theory or explanation needed to learn how to use the computer, the respondents' answers varied, with the most frequent response being 4-5 hours. The actual hands-on experience averaged 4-6 hours. The estimated cost in man hours per nurse varied according to salary scale at each particular hospital, the range being $8 to $11 an hour. One respondent answered that with four hours of theory and hands-on practice plus retraining and refresher courses at $8 per hour/per nurse the cost would be over $19,000 for their 600 nurses.

A hospital with 1,600 registered nurses used the following formula: Registered Nurse (RN) = Labor rate (LR) X Fringe Benefit (FB) plus Instructor LR X FB = Total Cost per Nurse (Table 2). Thus the cost for one hour of released time for 1,600 nurses would be $16,048.

Table 2

Cost to Train Nurses in Computer Use

	LR	X	FB	=	Total
RN	$ 8.50		$1.18		$10.03
Instructor	12.00		1.18		14.16
Total Cost Per Hour					$24.19

Another respondent indicated that nurses working in intensive care units (ICU) required 3.5 hours in computer training for each 1.5 hours required in other nursing units. The cost in a facility having 300 intensive care nurses using the same formula would be:

ICU/RN	LR X FB	Hours		Total Cost
300	$10.03	3.5	=	$10,531.50

The indication of the ICU man-hours being as high as 3.5 compared to 1.5 for other nursing units probably means that computer interface with instruments, intricate technology, and drug dosage calculations and administration all required a greater amount of computer training. No items on the survey questionnaire related to part-time employees. In response to suggestions for some type of computer education guide, the majority of those surveyed stated that they would like to have basic computer literacy, present and future applications for nursing use, basic terminology, reference materials, and basic procedures in such a guide.

Summary

Chapter 4 presented the results of the survey. The respondents, namely data processing personnel in the selected hospital sample, indicated that there was computer use in clinical care units (87 percent of the respondents). Sixty-nine percent indicated that computer use freed the nurse for more direct client care. They further indicated

there was limited computer interface with instruments (35 percent) and that computer interface with instruments occurs primarily in critical care units. Use of the computer by registered nurses (78 percent) and ward secretaries (91 percent) gave an indication of greater use by ward secretaries. The most frequent nursing use of computers was for laboratory requisitioning (63 percent) and charting of client care (56 percent).

Regarding educating nurses in computer use, 75 percent of the respondents believed that hospital in-service could provide the computer training nurses need. Thirty-six percent strongly believed that collegiate nursing programs should educate nurses in computer use for health care delivery. Most respondents did not answer the questions related to the cost involved to educate nurses in computer use. The most frequent response regarding basic time to learn computer use was 4-5 hours. The cost per man-hour varied and depended on individual nurse salary. Respondents gave an indication that training, retraining, and refresher courses were expensive to a hospital since they are based on the hourly nurse wages (e.g. $8 per hour/per nurse). Topics solicited for a computer education guide were numerous. They included basic terminology and procedures and showed a need for anticipated future computer applications as technology advanced computer use in health care delivery. As a result of the research and from the responses of the survey, a protoypical computer

education module for nurses was developed (Appendix I). An analysis was done of the surveyed hospitals with and without computers based on hospital bed size. The two groups were tested with the null hypothesis "hospital bed size being equal" to see whether that was a significant difference at the .05 level (Appendix H). A significant difference was found between the mean bed size in the two groups. The majority of the respondents with computers had s bed occupancy of more than 350 (56 percent) (Appendix E). Of the 90 hospitals responding that they had no computers, only 7 of the 90 had a bed capacity of over 500.

Chapter 5

INTERPRETATIONS, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to examine computers in hospital clinical nursing. Based upon a review of the literature for computer use in hospital nursing, four major research questions were formulated as follows: (1) How are computers used in hospital clinical nursing?; (2) Which hospital personnel use computers in the delivery of health care?; (3) What is the cost involved to educate hospital staff nurses in computer use?; and (4) Who should teach nurses how to use computers for health care delivery?

Based on the response bias analysis (Chapter 3) the findings indicated that it is generally the larger hospitals by bed size that currently use computers in hospital clinical nursing. Some possible reasons noted why computers are not as prevalent in smaller hospitals might include the following:

1. Prohibitive cost
2. Fewer admissions/discharges
3. Less teaching/research
4. Less specialized critical care

Likewise the findings showed that hospitals are computerizing in the nursing units. Eighty-seven percent of the

respondents reported that computers had advanced from nearly exclusive use as a managerial tool in admitting and finance offices to direct use in nursing units. Furthermore, respondents reported that computers are seen as an integral part of nursing care (82 percent). Sixty-nine percent indicated that the computer frees nurses for more direct client care. The research also showed that computers have found their way into many nursing units (more than 75 percent), including the emergency room, intensive care unit, obstetrical, medical, surgical, and pediatric units. Almost all hospital nursing units used the computer for information management, such as requisitioning laboratory tests, x-ray diagnostic tests, and requisitioning drugs from the pharmacy and diets from the dietary unit. The most frequent use was for laboratory reporting (86 percent) and for admissions and discharge of clients (95 percent).

From the data collected one may conclude that computers are being used by nurses in virtually all hospital clinical nursing units. There has been limited interface with instruments such as thermometers for temperature taking, for measurement of vital signs, for diagnostic purposes, or for drug calculations and drug administration control. The intensive care units did indicate some interface with instruments (45 percent). In the research question asking which hospital personnel use the computer, data showed that ward secretaries (91

percent) and registered nurses (78 percent) were the most frequent users of the computer. Resident doctors (44 percent) and doctors in general (43 percent) use the computer less than 50 percent of the time. Nurses' aides used the computer infrequently (25 percent). Therefore, the research results indicate that registered nurses who use the computer frequently have need of education in computer use and that computer use is an expected part of the ward secretaries' jobs. Results also show that doctors-in-training and doctors in general do not routinely use the computer. One might conclude that lack of interest, being too busy, or just being afraid to use a computer are possible factors causing their non-use of the equipment.

Most respondents did not answer the research questions relating to the cost involved in teaching hospital nurses use of the computer. Of those that answered, the data showed that the hours of theory varied. The most frequent response was 4-5 hours of teaching and this included hands-on experience. Regarding direct cost of educating nurses, the respondents indicated that cost was based on per/hour per nurse according to the hospital's pay scale for nurses. Most indicated educational cost to be expensive, e.g., over $19,000 for 600 nurses. Some reported that intensive care nurse education in computer use required 3.5 hours as compared to 1.5 hours for nurses in non-intensive care units.

The research data showed that cost for educating hospital staff nurses in computer use, in retraining, and in refresher courses is expensive. The data also showed that 82 percent of the nurses who use computers received computer education after beginning their employment. If one thinks in terms of rapid turnover of nurses and frequent mobility in the job market, the absorption of health care cost by the patient for computer education of nurses would be astronomical.

One further conclusion that might be made from the data is that because few respondents answered the questions related to the educational costs of nurses it is possible that most hospitals have not dealt with this issue. Hospitals may have absorbed the cost believing it was a necessity or a part of the over-all computer installation and start-up expense. As the computer becomes more widely used in hospitals, in-service training may become prohibitively expensive. While a particular computer system may require a certain amount of orientation, nurses who have received basic computer training prior to employment will represent a significant savings to clients and hospitals. Regarding the research question of who should teach nurses how to use the computers for health care delivery, the data showed that currently in-service personnel teach computer use (75 percent). Thirty-six percent strongly believe that collegiate nursing programs should teach nurses computer use for health care delivery.

Slightly less than half (42 percent) required nurses to type using the keyboard of the computer and 50 percent of the respondents indicated that formal typing skills were certainly desirable. Sixty percent stated that the computer specialist was needed to help the nurse and over half (56 percent) indicated the computer specialist was a nurse. The findings suggest that hospital administrators are comfortable using in-service personnel to teach nurses the use of computers for health care delivery. At the same time the data showed a belief (36 percent) that collegiate educators should assume responsibility. This fact, coupled with the cost to educate nurses and the 50 percent indicating that formal typing knowledge was desirable, gives indication of the need for further evaluation of who should educate nurses in computer use.

In summary the delivery of health care has developed considerably since the advent of computers. Nurses are becoming more and more exposed to the innovations made by computers. A major issue facing health computing professionals is how best to use the compputer hardware and software. An understanding by nursing managers of software, programming, and systems is becoming an essential component of their job descriptions. There are key application packages in word processing, in graphics, and in data bases that can enable nurses to provide better health care. An understanding of computer terms and concepts such as impact, output, processor,

memory, storage, and communication concepts will provide health care professionals with an appreciation of the ability of computers. In the more sophisticated computer, the value of interactive technologies such as pointing devises, pull-down menus, and voice impact and output have valuable places in the health field.

For this reason it is important that nurses have an understanding of computer jargon and a sense of what is essential information versus what is detail. While this is a must for managers of nursing, it would be nice if every nurse had an understanding of basic computer literacy. As this important technology penetrates more and more into the health delivery systems, it may become a standard educational requirement for prospective nurse employees. Furthermore, in order to keep health cost down, health care systems will have to do everything possible to reduce the dependence of the nurse on data processing personnel.

Recommendations for the Improvement of Practice, Including Strategies for Diffusion, Implementation, and Improvement

Recommendations from this study include the need for further research about computer application and use by nurse health care providers. This particular research project would need to be implemented on a wider scale in order to make a contribution which would improve the decision process of who should educate nurses in computer

education. Studies should be conducted by collegiate nurse administrators to determine what kind of computer education is needed by new graduates entering the health care field. Additional studies in cost analyses should be done by hospital administrators to determine the cost of providing computer education to staff nurses. Furthermore, studies should be conducted seeking information from nurses who use the computer in clinical nursing. A recommendation that would prove useful in replicating this study would be to find a standard instrument that has published reliability and validity and thus save time and expense. A final recommendation is to do two or three mailings in order to insure a higher percentage of returns.

One strategy for diffusion of the results of this research project will be to send a summary of the findings to all the participants who requested results. Another is to make the study available to the Norwich University nursing curriculum committee. A copy will be placed in the University library and one will be given to the University Faculty Development Committee.

It is anticipated that the nursing curriculum committee at Norwich University will study this research project. These findings should help members of the committee to make further decisions concerning what Norwich University nursing graduates should be taught about computers prior to entering the job market. To enhance

nursing education at Norwich University research is needed using nursing graduates who have been exposed to computer use in their studies versus those graduates who entered the work force without any previous exposure to computers during their education at Norwich.

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APPENDIX A

COVER LETTER

June 5, 1984

[gender] [fname] [lname]
[title]
[institution]
[addr] [zip]

Dear [fn]:

Would you or someone be so good as to answer this questionnaire and send it back to me, and please give me your opinion on the quality of the questions.

About myself--the Hospital Sisters own hospitals in Canada and the United States. In Vermont, we have Fanny Allen Hospital and DeGoesbriand Hospital, which is now part of the Medical Center Hospital of Vermont.

This questionnaire is part of my doctoral dissertation to analyze computer use in hospital clinical nursing and its implications for nursing education in computer use.

Your help in this analysis would be most appreciated.

Sincerely,

Sister St. Thomas
Associate Professor of Nursing

SST:mrs

Enclosure

APPENDIX B

QUESTIONNAIRE

The following items represent the need for computer knowledge by nurses, computers currently used in health care delivery, and the necessity of computer knowledge for job performance. Based on computer use at your institution, please indicate how important you believe each item is by circling one choice according to these rating categories:

(1) = NO IMPORTANCE
(2) = LOW IMPORTANCE
(3) = MEDIUM IMPORTANCE
(4) = HIGH IMPORTANCE
(5) = VERY HIGH IMPORTANCE

Example: LOW HIGH

Being alive 1 2 3 4 5

Computers are in use at this hospital since _____.
(indicate year)

ITEM:

(1) Computers in this past year have advanced from the financial offices of our hospital into nursing units . . 1 2 3 4 5

(2) Computers are used in the actual delivery of nursing care 1 2 3 4 5

(3) Computers are used in:
Emergency Room 1 2 3 4 5

(4) Intensive Care 1 2 3 4 5

(5) Obstetrics 1 2 3 4 5

(6) Medical Unit 1 2 3 4 5

(7) Surgical Unit 1 2 3 4 5

(8) Pediatrics 1 2 3 4 5

		LOW	HIGH
(9)	There is computer interface (such as thermometers) for client care	1 2 3 4 5	
(10)	In Intensive Care Units	1 2 3 4 5	
(11)	In Medical/Surgical Units	1 2 3 4 5	
(12)	Other	1 2 3 4 5	
(13)	Computers are used in continuing education of nurses	1 2 3 4 5	
	Computers are used in client care:		
(14)	To record vital signs	1 2 3 4 5	
(15)	To compute and administer drugs .	1 2 3 4 5	
(16)	For Laboratory reporting	1 2 3 4 5	
(17)	For Admission/Discharge and Transfer Information	1 2 3 4 5	
(18)	For Information Management	1 2 3 4 5	

COMMENTS:

(19)	The nursing units have video display terminals	1 2 3 4 5	
(20)	Printers	1 2 3 4 5	
	Who uses the computer?		
(21)	RN's	1 2 3 4 5	
(22)	LPN's	1 2 3 4 5	
(23)	AIDE's	1 2 3 4 5	
(24)	WARD SECRETARY	1 2 3 4 5	

		LOW				HIGH
(25)	RESIDENT/INTERNS	1	2	3	4	5
(26)	PHYSICIANS	1	2	3	4	5
(27)	The computer in the nursing unit communicates doctors' orders	1	2	3	4	5

COMMENTS:

(28)	The computer provides the nurse with patient assignments and patient profile	1	2	3	4	5
(29)	Nurses use the computer to prepare laboratory requisitions . . .	1	2	3	4	5
(30)	Nurses use the computer for client records, charting medication data, and other data	1	2	3	4	5
(31)	To develop patient care plans . .	1	2	3	4	5
(32)	To prepare discharge instructions for clients	1	2	3	4	5
(33)	To store data related to standards of care and procedures . . .	1	2	3	4	5
(34)	In storing research data (i.e., subject selection, protocol distribution, and data retrieval) . .	1	2	3	4	5
(35)	High frequency order entry screens are in use on nursing units	1	2	3	4	5
(36)	There is a necessity for knowledge by nurses of computers prior to employment	1	2	3	4	5
(37)	Prior knowledge of computers by nurses does facilitate job placement for nurses upon employment in our institution	1	2	3	4	5

	LOW HIGH
(38) Knowledge of computers would facilitate job placement	1 2 3 4 5
(39) Nurses are trained to use the computer after employment	1 2 3 4 5
(40) Computer knowledge is essential for nurses working in intensive care units	1 2 3 4 5
(41) Nurses are required to type information into the computer	1 2 3 4 5
(42) The type of video screen used is activated by touch (screen)/ light pen	1 2 3 4 5
Who teaches computer use to nurses?	
(43) In-Service	1 2 3 4 5
(44) Computer Specialist	1 2 3 4 5
(45) Other	1 2 3 4 5
If computer use is taught to nurses:	
(46) How many hours of theory?	_____Hours
(47) How many hours of hands-on computer experience	_____Hours
(48) Estimated cost in man hours per nurse?	$_____
(49) Nurses using computer receive higher wages than nurses not using computers	1 2 3 4 5

COMMENTS:

	LOW	HIGH
(50) A computer specialist is needed to help the nurses	1 2 3 4 5	
(51) Daily	1 2 3 4 5	
(52) Weekly	1 2 3 4 5	
(53) On-call	1 2 3 4 5	
(54) If on-call, the specialist is used frequently	1 2 3 4 5	
(55) Estimated cost to nursing for computer specialist	$_____	

Who do you believe should educate nurses in computer use?

(56) Hospital In-service	1 2 3 4 5	
(57) Collegiate nursing programs . . .	1 2 3 4 5	
(58) Hospital-hired computer specialist	1 2 3 4 5	
(59) Our computer specialist is also a programmer	1 2 3 4 5	
(60) Our computer specialist is a nurse .	1 2 3 4 5	
(61) The computer is a viable tool in nursing care	1 2 3 4 5	
(62) The computer frees the nurse for more direct client care	1 2 3 4 5	
(63) A nurse with pre-employment computer education is more cost-effective than the nurse with no prior computer knowledge	1 2 3 4 5	
(64) Collegiate nursing educators should prepare nurse for computer use . . .	1 2 3 4 5	
(65) Typing education is a must	1 2 3 4 5	

(66) Do you have and use a written Guide for Computer Use By Nurses? _____YES _____NO

(67) Computers in nursing care at this institution was started in:

1980_____ 1981_____ 1982_____ 1983_____

COMMENTS:

(68) If I were to develop a computer guide for nurses, what do you suggest should be included?

COMMENTS:

(69) Thank you for your help. May I write or call for further information?

_____
NAME

_____
ADDRESS

_____
ZIP

_____
TELEPHONE EXTENSION

APPENDIX C

United States Regions Used in Data Base

Region 1	Region 2	Region 3	Region 4	Region 5
Connecticut	Delaware	Illinois	Arizona	Alaska
Maine	Washington, DC	Indiana	Colorado	California
Massachusetts	Kentucky	Michigan	Idaho	Hawaii
New Hampshire	Maryland	Ohio	Montana	Nevada
Rhode Island	North Carolina	Wisconsin	New Mexico	Oregon
Vermont	Virginia	Iowa	Utah	Washington
New Jersey	West Virginia	Kansas	Wyoming	
New York	Florida	Minnesota	Arkansas	
Pennsylvania	Georgia	Missouri	Louisana	
	South Carolina	Nebraska	Oklahoma	
	Tennessee	North Dakota	Texas	
	Mississippi	South Dakota		
	Alabama			

APPENDIX D

Percentages of Returns by Regions

Region 1	Region 2	Region 3	Region 4	Region 5
Connecticut	Delaware	Illinois	Arizona	Alaska
Maine	Washington, DC	Indiana	Colorado	California
Massachusetts	Kentucky	Michigan	Idaho	Hawaii
New Hampshire	Maryland	Ohio	Montana	Nevada
Rhode Island	North Carolina	Wisconsin	New Mexico	Oregon
Vermont	Virginia	Iowa	Utah	Washington
New Jersey	West Virginia	Kansas	Wyoming	
New York	Florida	Minnesota	Arkansas	
Pennsylvania	Georgia	Missouri	Louisana	
	South Carolina	Nebraska	Oklahoma	
	Tennessee	North Dakota	Texas	
	Mississippi	South Dakota		
	Alabama			

Number of Studied Hospitals,
by Region and Bed Size

	Bed Size							
Region	50-200	201-350	351-500	501-650	651-800	801-950	951-Over 1,250	Total
1	5	6	13	2	1	1	5	33
2	7	8	8	5	4	1	1	34
3	8	8	8	6	3	-	2	35
4	4	5	2	1	1	1	1	15
5	5	-	3	2	-	1	2	13
Total	29	27	34	16	9	4	11	130

APPENDIX F

LETTER OF INFORMED CONSENT

Dear Administrator:

I am conducting a survey as part of a doctoral dissertation at Nova University in Florida. The purpose of the survey is to explore the need for computer knowledge in clinical nursing in hospitals.

As you know, the explosion of computer technology is upon us, and as employers of registered nurses in the delivery of health care, appropriate educational preparation for working with computers is essential. I am interested in knowing how computers are used in health care delivery at your institution, the amount of computer knowledge you require nurses to have or would like them to have, and if they have or had such knowledge, would it make a difference in registered nurses' job placement within your institution?

All information in this survey is confidential. Under no circumstances will participants be directly identified with the results. You are free to withdraw your consent and to discontinue participation at any time. Any question you have about the project will be answered.

It is anticipated that the results of this study will be of benefit to employers of nurses, educational institutions, and nurses in general. Please take a few minutes to respond to the questionnaire. Your time and interest in contributing to the successful outcome of this study are greatly appreciated.

Sincerely,

Theresa A. Thomas, R. N.
Associate Professor
Vermont College of
Norwich University
Montpelier, VT 05602

TAT:mrs

APPENDIX G

Test of Proportions

A test of proportions to check for response bias by region. The extremes; i.e. highest return rate were statistically tested against the lowest return rate.

Survey by Regions

Regions -	1	2	3	4	5	Total
Number Sent Out -	61	58	90	36	29	274
Number Replying -	29	26	43	19	13	130
Percent Reply -	P_1 47.5	P_2 44.8	P_3 47.8	P_4 52.8	P_5 44.8	

Null Hypothesis

$$HO: P_1 = P_2 = P_3 = P_4 = P_5$$

Alternate Hypothesis

$$HI: P_1 = P_2 = P_3 = P_4 = P_5$$

Statistical Test

$$z = \frac{\frac{x_1}{n_1} - \frac{x_2}{n_2}}{\sqrt{\bar{p}\,\bar{q}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

where $$p = \frac{x_1 + x_2}{n_1 + n_2}$$

$$\bar{q} = 1 - \bar{p}$$

APPENDIX G (cont.)

Test of Proportions

two tail test with alph (x) = .05

Comparison of response rate between regions 2 and 4

$$z = \frac{.5277 - .4483}{\sqrt{(.2495)(\frac{1}{58} + \frac{1}{36})}} \qquad \bar{p} = .4787 \quad \bar{q} = .5212$$

$z = .7492$ (not in rejection region)

$\therefore$ do not reject null hypothesis

Comparison of response rate between regions 4 and 5

$$z = \frac{.5278 - .4483}{\sqrt{(.2365)(\frac{1}{36} + \frac{1}{29})}} \qquad \bar{p} = .4923 \quad \bar{q} = .5077$$

$z = .6592$ (not in rejection region)

$\therefore$ do not reject the null hypothesis

Conclusions: it appears that there is a similar response rate from each region.

APPENDIX H

Null Hypothesis "Hospital Bed Size Being Equal"

Responding Hospitals

(no computers used) $N_1 = 40$

average bed size $\bar{X} = 379$

$S = 272$

Responding Hospitals

(with computer use) $N_1 = 90$

average bed size $\bar{X} = 468$

$S = 271$

Null Hypothesis $H_o : M_1 - M_2 = 0$

Alternate Hypothesis $H_1 : M_1 - M_2 \neq 0$

S^2 used for $\sigma 2$

$X = .05$ level significance

$Z = -1.96$ (critical value)

$$Z = \frac{x_1 - x_2}{\sqrt{\frac{\sigma.2}{n_1} + \frac{_2}{n_2}}}$$

$$= \frac{379 - 468}{\sqrt{\frac{73984}{40} - \frac{73441}{90}}}$$

$$= \frac{-89}{\sqrt{1849 - 816}}$$

$$= \frac{-89}{33} = 2.72$$

APPENDIX I

PROTOTYPICAL COMPUTER EDUCATION MODULE FOR NURSES

The goal of the prototype is to define the structure of the computer and to explain how the nurse can use a computer to enhance nursing care. Given the ability to input data and retrieve data, the nurse will be able to generate nursing care plans, requisition tests, disseminate information, document nursing care data, and manage computerized physiological monitoring and imaging.

Terminal Objectives

1. Know computer terminology.
2. Understand briefly the evolution and history of computers.
3. Understand potential uses of computers in nursing administration, research, and clinical nursing.
4. Be able to enter data and retrieve data from the computer.
5. Be able to admit and discharge clients using the computer.
6. Be able to develop nursing care plans based on the nursing process.
7. Know management of computerized imaging and physiological monitoring.
8. Understand down time.
9. Be able to manage problems arising from computer use.

Chapter I - A Short History of Computing

A. Abacus

B. Punched cards

C. Analytical engine

D. Hollerith code

E. Mark I

F. ENIAC (electronic numerical integrator and calculator)

G. Stored instructions

H. Transistors and integrated circuits

I. Micro-computer

Chapter II - Computer Terms Defined and Explained

A. Input data

B. Input devices

C. Program

D. Computer language

E. CPU

F. Memory

G. Output devices

H. Hardware

I. Software

J. CRT

K. Cursor

L. Down time

M. File

N. Computer operator technician

O. Computer programmer

P. Computer systems analysts

Chapter III - Potential Uses in Nursing

A. Nursing administration

1. staffing and scheduling
2. nursing audit
3. statistical reporting
4. patient classification
5. continuing education

B. Nursing research

1. development of programs to test nursing theory
2. collection and storage of research data
3. analyses of data

C. Clinical nursing

1. application of the nursing process (assessment, nursing diagnosis, planning, implementation and evaluation)
2. documentation of client care
3. computerized imaging and physiological monitoring
4. drug bibliography
5. literature search
6. client education

Chapter IV - Hands-on Application in Computer Use

A. Keyboard

1. general

2. special

B. Activating computer

1. Hello/bye

2. cursor

3. touch screen

4. light pen

C. Data management

1. storage

2. retrieving

D. Interdepartmental transactions

1. requisitioning test/information from pharmacy, laboratory, and dietetics

2. receiving information from pharmacists, laboratory technician and dietitian

Chapter V - Specific Transactions

A. admitting new clients

B. transferring clients

C. discharging clients

D. educating clients for discharge

E. developing nursing care plans

F. documenting client care

G. inventorying of equipment and supplies

H. using computerized physiological imaging and monitoring

Chapter VI - Retrieving Information

A. monitor

B. printed

1. types

2. activating

Chapter VII - Management

A. computer-operator technician functions

B. computer programmer functions

C. computer systems analyst functions

D. down-time management

Chapter VIII - Ethical/Legal Issues

A. confidentiality

B. piracy

BIOGRAPHICAL SKETCH OF PARTICIPANT

Sister St. Thomas (Theresa Ann Thomas) was born in Shelburne, Vermont. She graduated from Shelburne High School and in 1953 completed education for nursing and became a registered nurse in the State of Vermont. She received the baccalaureate degree in nursing from Boston College in 1963 and a master's degree in nursing from Teachers College, Columbia University in 1965. She has held supervisory positions at Fanny Allen Hospital and DeGoesbriand Hospital in Vermont and at Notre Dame Hospital in Maine. She began teaching nursing at the Jeanne Mance Nursing School (Burlington, VT) in 1965 and joined the faculty at Vermont College, Montpelier, Vermont in 1969. In 1972, she joined the faculty of Norwich University, Northfield, Vermont, and is currently a tenured Associate Professor. She was a contributing author to Maternity Nursing by Schultz and Dickenson. She has been a writer for Health, Education and Welfare grants entitled "Development of Selective Modules of Learning" and the Special Project Grant "Developing Outreach Satellite Program." Sister St. Thomas is a member of the Religious Hospitallers of St. Joseph.